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Analysis of voltage graph in the charging and unloading of various lithium-ion batteries

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SUMMARY

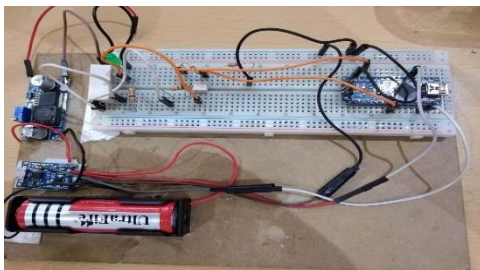
Este trabajo de investigación consiste en medir el voltaje de la carga y descarga de varias baterías de iones de litio y luego analizar los gráficos de voltaje obtenidos. Para ello se elaboró un circuito basado en una placa de Arduino Nano para registrar datos de voltaje de la carga y descarga cada cierto tiempo, este tiempo es programable; el circuito considera un módulo de protección el TP4056 que protege a la batería de una posible sobretensión y una tensión de descarga exagerada, ocasionado en consecuencia una mayor vida útil de la batería de iones de litio.

INTRODUCTION

Today, it is common to communicate more by mobile phone, use a laptop and travel more and more, on electric scooters, electric bikes, and electric cars, etc. All of them depend on the proper operation of the element that provides the power needed for the operation of all these devices indicated above. This is the lithium-ion battery.

METHODOLOGY

The objective of this project is to experimentally determine the voltage curve of various lithium-ion batteries up to the maximum cut when charging and minimum cutting when unloading by designing a circuit using an Arduino Nano board and TP4056 module. At the same time another circuit is used to determine the current curve in lithium-ion batteries in both charging and discharge.



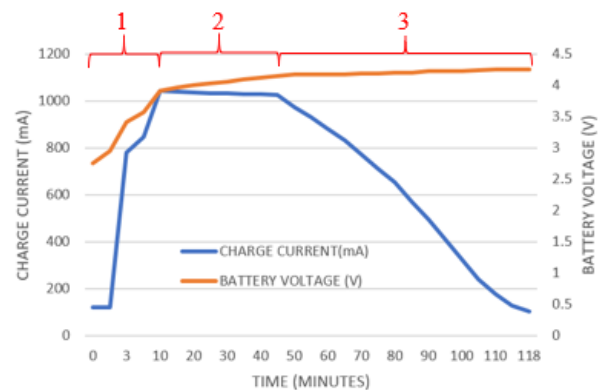
Circuit photo with Arduino Nano and TP4056 module used in lithium-ion battery voltage measurements.



Photo of the circuit used in lithium-ion battery current measurements.

RESULTS AND DISCUSSIONS

With the voltage and current data collection the following graph was obtained in the charging process for a lithium-ion battery.



- 1) *Stage 1:* It presents a fast charge in a short time and the current remains constant and then grows rapidly until it takes a constant value.
- 2) *Stage 2:* A less fast charge begins and the current is almost constant at this stage.
- 3) *Stage 3:* It has a much slower load and the current begins to decay.

CONCLUSIONS

Having performed various tests with three different types of lithium-ion battery brands, it can be concluded:

Lithium-ion battery	
Maximum charging and cutting voltage	4.24V-4.25V
Minimum discharge and cutting voltage	2.55V-2.60V

BIBLIOGRAPHY

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